FINAL REPORT

EXECUTIVE SUMMARY

SPECIFIED FACILITY ENERGY STUDIES FOR ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP) AT U.S. ARMY SUPPORT COMMAND, HAWAII (USASCH) INSTALLATIONS

FT. SHAFTER
TRIPLER ARMY MEDICAL CENTER
SCHOFIELD BARRACKS

Prepared For:

Department of the Army
Pacific Ocean Division
Corps of Engineers

SEPTEMBER, 1987

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.

Marie Wakefield,
Librarian Engineering

EXECUTIVE SUMMARY
TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

1. Introduction

1.1 General

This energy savings opportunity study was undertaken as part of the Energy Engineering Analysis Program (EEAP). A previous EEAP study was conducted in 1981 for USASCH installations - Ft. Shafter, Schofield Barracks, and Tripler Army Medical Center. That study examined each installation as a whole in order to develop an installation-wide energy conservation plan. The present study examines just 25 designated buildings at Ft. Shafter, Schofield Barracks, and Tripler Army Medical Center.

1.2 Report Organization

At the direction of the using agency, the reporting was organized into three volumes. The first volume covers the results of the analysis of 12 buildings at Ft. Shafter and one building at Tripler Army Medical Center. The second volume covers the results of the analysis of 12 buildings at Schofield Barracks. The third volume contains the Programming Documents of all projects developed for all three installations. At the direction of U.S. Army Engineer Division, Huntsville, all results have been combined into a single Executive Summary, copies of which appear in both the Ft. Shafter/Tripler report and the Schofield Barracks report. Per the SOW, the Executive Summary has also been separately bound.

1.3 Study Methodology

The study team first performed a limited field survey of the designated facilities. Survey data was recorded on forms, or notated directly on the drawings and in notebooks. Plan files at the installation were searched during September, 1985, to find and obtain relevant as-built drawings for the buildings to be surveyed. Prior to the start of the field surveys, an Entry Briefing was given on October 29 to brief Army staff on details of the field survey implementation. The field surveys were conducted during the month of November, 1985. An Exit Briefing was held on December 5, to present the preliminary findings of the field survey.

During the limited field inspections of the buildings, the field survey team identified applicable ECO's. For these ECO's, the energy savings were estimated, and a cost estimate was prepared. The energy savings and cost estimates were the basis of the life cycle cost analysis (LCCA) which determined the feasibility of each ECO. Per the scope of work, the latest revision of Army ECIP Guidance was used as the format for the LCCA. Cost effective projects are those for which the Savings Investment Ratio (SIR) is 1.0 or greater, and for which the payback period is less than 10 years. Packaging of feasible ECO's as programmed projects was made at the direction of the using agency. Programming documents were then prepared for the projects.

2. Building Data

In Table 1 are listed the ID number and designation of each building, its category code(s), and floor area. A simple narrative description of each building follows.

2.1 Ft. Shafter Buildings

2.1.1 Building 220 -- ADP Building

Description: This is a single-story CMU and concrete building, with metal roofing on steel trusses and purlins, and equipment mezzanine in attic. Although building 220 has been utilized as a data processing facility since at least 1962, the building design is obsolete for present computing facility requirements. Air conditioning and electrical systems have been added and modified incrementally over the past 25 years to accommodate newer and larger computing equipment. Air conditioning consists of five packaged water-cooled and air-cooled compressor/fan-coil units and two DX fan-coil units with remote ACCU. Lights are fluorescent type. There is no hot water.

2.1.2 Building 500 -- Richardson Theater

Description: This is a two-story, concrete structure with flat roof, with pitch and gravel roofing on wood plank deck. Built in 1948, the building has been renovated and is maintained in generally good condition. Air conditioning and electrical systems were replaced in

TABLE 1. BUILDING DATA

BLDG. NO.	DESCRIPTION	CATEGORY CODE(S)	AREA (SF)
FT. SHAFTER:			
220	ADP Bldg.	610-31	21,285
500	Richardson Theater	740-76	18,297
550	Main Exchange	740-53	37,820
640	Skyview Terrace (NCO Club)	740-47	24,045
660	Bowling Center	740-11	10,656
665	Gymnasium	740-34	20,844
710	Officer's Club	740-48	25,739
715	Roundhouse Restaurant (Officer's Club Annex)	740-90	5,674
716	Golf Clubhouse	740-30	2,450
718	Staff Judge Advocate	740-14	4,472
1543	Theater Intelligence Command Data Center	610-31	5,880
1547	Contracts Administration	610-50	5,400
	Subtotal: 12 bldgs.		182,562
TRIPLER ARMY MEDICAL CENTER:			
40	Laboratory	610-25 610-28	23,192
SCHOFIELD BARRACKS:			
549	Troop Barracks, Quad "E"	721-10	66,304
550	Troop Barracks, Quad "E"	721-10	88,191
552	Troop Barracks, Quad "E"	721-10	86,458
557	Bowling Center	740-11	31,609
586	Conroy Grill	740-56	2,495
660	Dental Clinic	540-10	17,930
693	Main Exchange	740-53	47,172
858	Troop Barracks, Quad "K"	721-11	85,505
859	Troop Barracks, Quad "K"	721-11	85,505
860	Troop Barracks, Quad "K"	721-11	64,682
2091	Open Dining NCO	740-47	23,186
2800	Fixed Laundry	730-30	36,090
	Subtotal: 12 bldgs.		635,127
	Total, all installations		840,881

1985. Richardson Theater is used for live theater performances, motion picture screenings, command ceremonies and training exercises. Air conditioning is provided by a central DX split system. Lights are incandescent type. There is no hot water.

2.1.3 Building 550 -- Main Exchange

Description: This is a single-story, CMU building with metal siding, metal frame roof and corrugated roofing. Renovated in 1984, the building is in good condition. Air conditioning is a chilled water system, with a packaged chiller, 2 remote condensers, and 4 single-zone, constant-volume air handling units. Most light fixtures are fluorescent type, but incandescents are used for spotlighting and security. There is no hot water.

2.1.4 Building 640 -- Skyview Terrace (NCO Dining Club)

Description: This is a four-story, circular concrete building with built-up roofing on a wood deck over the open-air lanai. Built in 1973, good condition. Skyview Terrace is notable for its novel circular architecture, and sweeping views of Honolulu from its hill-top location. Air conditioning is a chilled water system, with 2 packaged air-cooled chillers, and two multi-zone air handling units. Light fixtures are primarily fluorescent type, although incandescents are used for spotlighting. Hot water is provided by recovering heat from the chillers. Dishwasher hot water is boosted electrically.

2.1.5 Building 660 -- Bowling Center

Description: This is a single-story CMU structure with pitch and gravel roofing over pre-stressed concrete roof. Constructed in 1968, the building is in good condition. The Ft. Shafter Bowling Center currently has 12 lanes, but it planned to expand the facility by 10 lanes in FY-87. Air conditioning is provided by 2 packaged air-cooled units. Lights are primarily fluorescent type, but incandescents are used for spotlighting. There is an electric water heater that serves the grill.

2.1.6 Building 665 -- Gymnasium

Description: This is a single-story CMU structure with pitch and gravel roofing on pre-cast concrete slab. Built in 1973, the building is in good condition. The building is not air-conditioned, but is ventilated by a system of supply and exhaust fans. Lighting is fluorescent type, except in the handball and squash courts, where mercury vapor fixtures are used.

2.1.7 Building 710 -- Officers' Club

Description: This is a single-story wood frame and CMU structure, with built-up roofing on wood frame and roof decking. Constructed in 1942, the building is in fair condition. The facility has luncheon and banquet facilities, a bar and dance hall, and a swimming pool. There are two window air conditioning units. Most of the lighting fixtures are incandescent, although fluorescents are used in service areas. Hot water is provided by an oil-fired and a gas-fired water heater. There are also heat recovery units installed with the refrigeration compressors.

2.1.8 Building 715 -- Roundhouse Restaurant

Description: This is a single-story circular stone masonry structure, with pitch and gravel roofing on wood frame roof. This facility is operated as part of the Officers' Club complex, Building 710. Utilization of the building is characterized by peak periods for lunch and dinner, with little activity between these two times. Air conditioning is provided by four packaged window units. Most of the lighting fixtures are incandescent type, provided with dimmer switches, although fluorescents are also used in service areas.

2.1.9 Building 716 -- Golf Clubhouse

Description: This is a single-story CMU structure with built-up roofing on concrete roof slab. The building is in fair condition. Air conditioning is provided by four packaged window units. Lighting fixtures are fluorescent type, except for exterior incandescent floodlights. There is no hot water.

2.1.10 Building 718 -- Staff Judge Advocate

Description: This is a single-story concrete structure with pitch and gravel on concrete roof deck. Previously used as a child care center, this building was recently renovated with the partitioning of space into offices and the installation of air conditioning and lighting systems. Air conditioning is a chilled water system, with a packaged air-cooled chiller and four single-zone, constant-volume fan-coil units. Lighting fixtures are fluorescent type. There is no hot water.

2.1.11 Building 1543 -- Theater Intelligence Command Data Center

Description: This is a single-story concrete structure with built-up roofing on concrete roof deck. Constructed in 1970, this building is in good condition. Air conditioning consists of two independent split DX systems. Lighting fixtures are fluorescent type. There is no hot water.

2.1.12 Building 1547 -- Contracts Administration

Description: This is a single-story CMU structure with pitch and gravel roofing on metal roof deck. Constructed in 1974, this building is in good condition. The building envelope is well-designed from the energy conservation standpoint. Insulated roof, window overhangs, use of reflective window film and curtains all contribute to minimize external heat gains. Air conditioning is a chilled water system, with a packaged air-cooled chiller and two single-zone, constant-volume fan-coil units. Lighting fixtures are fluorescent types, except for exterior incandescent floodlights. There is no hot water.

2.2 Tripler Army Medical Center Buildings

2.2.1 Building 40 - Laboratory Building

Description: This is a three-story concrete building with concrete roof. Built in 1948, the building is maintained in fair condition. This building was undergoing renovation of the third floor at the

time of the field survey. The renovation includes a re-roofing of the structure, and installation of air conditioning on the third floor. Air conditioning for the rest of the building consists of packaged window units. Lighting fixtures are fluorescent type, except for exterior incandescent floodlights. Hot water and steam are provided by an oil-fired boiler.

2.3 Schofield Barracks Buildings

2.3.1 Quad "E" -- Buildings 549, 550, 552

Description: The buildings of Quad "E" are troop barracks. They are each 3-story concrete structures with pitch and gravel roofing on metal roof decking. In generally good condition, the buildings were renovated in 1978. Quad "E" is inhabited by the 19th Infantry. Building 549 is the Headquarters Building, and contains some troop quarters. Building 550 contains troop quarters and a mess hall. Building 552 consists of troop quarters and Company operations and administration areas. The air conditioning for the Quad consists of chilled water systems. There is a packaged air-cooled chiller for each building, and single-zone, constant-volume fan-coil units in all the rooms. Lighting in the troop quarters is incandescent type, while the common areas utilize fluorescent fixtures. Hot water is produced by oil-fired water heaters, one for each building.

2.3.2 Building 557 -- Bowling Center

Description: This building is a single-story CMU structure with aluminum roofing on steel trusses and purlins. Constructed in 1974, the building is in generally good condition. Air conditioning for this building consists of a split packaged system, with two air-cooled condensing units located outside the building. A direct-expansion, single-zone, constant volume fan-coil unit with two stages of cooling is located in a mechanical room inside the building.

2.3.3 Building 586 -- Conroy Grill

Description: This building is a single-story CMU structure with pitch and gravel roofing on a wood roof frame and wood sheathing. Conroy

Grill is a popular snack bar on base. Renovated in 1971, the building is in good condition. Air conditioning is a packaged split system, with exterior condensing unit, and an exterior pad-mounted, direct-expansion, single zone, constant volume fan-coil unit. Fluorescent light fixtures are installed in the serving area, the kitchen, and the office. The dining area and exterior floodlights are incandescent fixtures. Hot water is provided by an electric water heater.

2.3.4 Building 660 -- Dental Clinic

Description: This building is a single-story CMU structure with stucco finish, pitch and gravel roofing on a concrete roof slab. Constructed in 1984, the building is in excellent condition. Air conditioning is provided by a solar-powered absorption chiller, which circulates chilled water to single-zone, constant-volume fan-coil units throughout the building. Lighting is fluorescent type throughout, except that skylights are also used to provide daylighting in some areas. Hot water is provided by solar collector panels mounted on the roof. An oil-fired boiler is used to supplement and backup the solar collector system.

2.3.5 Building 693 -- Main Exchange

Description: This building is a single-story CMU structure with pitch and gravel roofing on a metal roof deck. Constructed in 1970, and expanded in 1982, the building is in good condition. Air conditioning for this building is a chilled water system. A packaged chilled water unit with 6 air-cooled condensers is located in a mechanical enclosure at the rear of the building. This circulates chilled water to a supply air system consisting of 14 single-zone, constant-volume air handlers. Most of the lighting is by fluorescent fixtures, although the retail areas use incandescent spotlights, and the storage bay has high-pressure sodium fixtures. There is no central hot water system. Spot hot water needs are provided by six small electric water heaters.

2.3.6 Quad "K" -- Buildings 858, 859, 860

Description: The buildings of Quad "K" are troop barracks. They are each 3-story concrete structures with pitch and gravel roofing on metal roof decking. In generally good condition, the buildings were renovated in 1983. The air conditioning for the Quad consists of chilled water systems. There is a packaged air-cooled chiller for each building, and single-zone, constant-volume fan-coil units in all the rooms. Lighting in the troop quarters is incandescent type, while the common areas utilize fluorescent fixtures. Hot water is produced by roof-mounted solar collector panels, with backup by oil-fired water heaters, one for each building. Quad "K" is inhabited by the 25th Infantry. Building 860 is the Head quarters Building, with some troop quarters. Buildings 858 and 859 consist of troop quarters and Company operations and administration areas.

2.3.7 Building 2091 -- NCO Open Dining

Description: This building is a single-story CMU structure with pitch and gravel roofing over metal roof decking. Older portions of the building also have a concrete roof slab over the metal roof decking. Constructed in 1962, and expanded in 1967, the building is in good condition. It is currently undergoing renovations to the Disco, and further renovations of the administration offices are planned. Air conditioning is provided by four packaged, single zone, constant volume systems, located on the roof. Incandescent light fixtures are used in the dining areas and for exterior floodlights. Fluorescent light fixtures are used in other areas. Hot water for the kitchen is provided by an oil-fired water heater, and a 650-gallon storage tank. There is also a small electric water heater for the restrooms.

2.3.8 Building 2800 -- Fixed Laundry

Description: This building is a single-story CMU building with boiler room annex. The roof consists of pitch and gravel roofing on a metal roof frame. Constructed in 1965, the building is in good condition. There is no air conditioning in this facility. Lighting in the facility is provided by mercury-vapor and fluorescent

fixtures. Steam and hot water requirements are provided by two oil-fired boilers.

2.4 Proportion of Total Installation Within This Study's Scope

The number of buildings and the floor area within the scope of this study are small fractions of the total buildings and floor areas of the entire installations, as the following data in Table 2 show:

TABLE 2. PERCENTAGES OF NUMBERS OF BUILDINGS AND FLOOR AREA OF BUILDINGS INCLUDED IN THIS STUDY AS COMPARED TO THE ENTIRE INSTALLATIONS.

Installation	Schofield Barracks	Ft. Shafter	Tripler Army Medical Cntr
A. Number of Buildings:			
1. Total Installation	2,400	484	110
2. This Study	12	12	1
3. Percentage of Total Installation	0.5	2.5	0.9
B. Floor Area:			
1. Total Installation	12,589,400	2,794,900	2,016,000
2. This Study	635,127	182,562	23,192
3. Percentage of Total Installation	5.0	6.5	1.2

3. Present Energy Consumption

3.1 Total Annual Energy and Source Energy Consumption - Installations

Available data from USASCH files show that FY-1986 energy consumption at the various installations was as shown in Table 3 (illustrated in Figure 1). Energy consumption totals for each installation are also broken out into the various source energy types: electricity, oil, and gas. The grand total of energy consumption at all three installations was 630,164 MBTU, and total cost was $11,309,544.

TABLE 3. PRESENT ENERGY CONSUMPTION

SCHOFIELD BARRACKS:

Type of Energy	Quantity	Unit	Cost ($)	MBTU
Electricity	94,947	MWH	6,646,368	324,055
No. 2 Oil	219,495	GAL	179,924	30,444
No. 5 Oil	126,649	GAL	96,157	18,744
LPG	254,821	GAL	261,931	24,208
Totals			7,184,380	397,451

FT. SHAFTER:

Type of Energy	Quantity	Unit	Cost ($)	MBTU
Electricity	22,395	MWH	1,623,437	76,433
No. 2 Oil	46,236	GAL	37,901	6,413
SNG	80,060	THM	105,919	8,006
Totals			1,767,257	90,852

TRIPLER ARMY MEDICAL CENTER:

Type of Energy	Quantity	Unit	Cost ($)	MBTU
Electricity	28,336	MWH	2,124,763	96,712
No. 2 Oil	14,138	GAL	11,590	1,961
No. 5 Oil	291,811	GAL	221,554	43,188
Totals			2,357,907	141,861

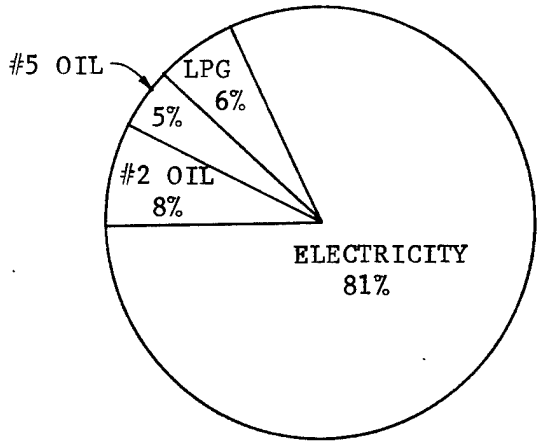
Grand Totals, All Installations:

Type of Energy	Quantity	Unit	Cost ($)	MBTU
Electricity	145,678	MWH	10,394,568	497,200
No. 2 Oil	279,869	GAL	229,415	38,818
No. 5 Oil	418,460	GAL	317,711	61,932
LPG	254,821	GAL	261,931	24,208
SNG	80,060	THM	105,919	8,006
Totals			11,309,544	630,164

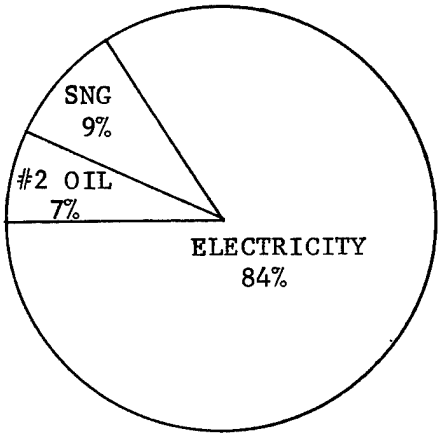
FIGURE 1. ENERGY CONSUMPTION OF BUILDINGS IN THIS STUDY COMPARED TO BASEWIDE ENERGY CONSUMPTION

BASEWIDE

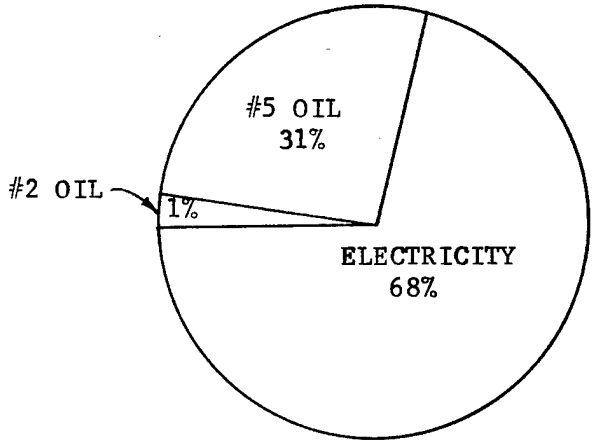
SCHOFIELD BARRACKS:
TOTAL 397,451 MBTU/YR



FT. SHAFTER:
TOTAL 90,852 MBTU/YR

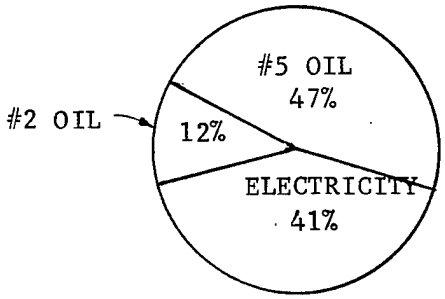


TRIPLER AMC:
TOTAL 141,861 MBTU/YR

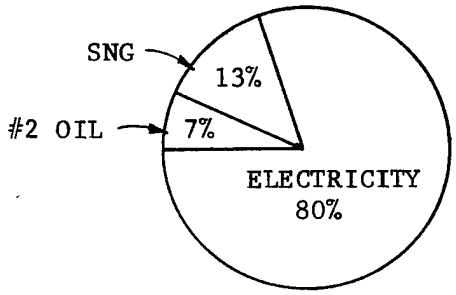


BUILDINGS IN THIS STUDY

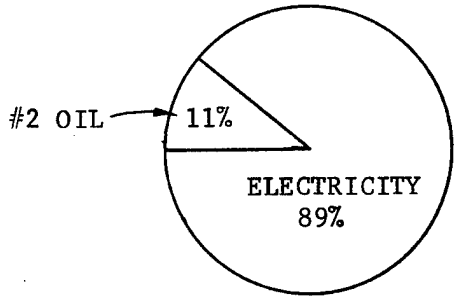
TOTAL 39,868 MBTU/YR



TOTAL 6,248 MBTU/YR



TOTAL 1,246 MBTU/YR



SOURCE: DERIVED FROM USASCH ENERGY DATA ON FILE

3.2 Energy Consumption of the Buildings in this Study as Compared to the Basewide Consumption

Available data from USASCH files and field survey data were used to estimate the energy consumption of buildings in this study. Where data was not available, the ratio of this study's buildings' total floor area to the basewide total building floor area was applied to the total annual source energy consumption to derive the following estimates of source energy consumption for the buildings in this study:

Type of Energy	Basewide (MBTU)	This Study(MBTU)	Percentage
Schofield Barracks:			
Electricity	324,055	16,348	5.0
No.2 Oil	30,444	4,776	15.7
No.5 Oil	18,744	18,744	100.0
LPG	24,208	0*	0.0
Totals	397,451	39,868	10.0
Ft. Shafter:			
Electricity	76,433	4,993	6.5
No.2 Oil	6,413	419	6.5
SNG	8,006	836	10.4
Totals	90,852	6,248	6.9
Tripler AMC:			
Electricity	96,712	1,112	1.2
No.2 Oil	1,961	134	6.8
No.5 Oil	43,188	0*	0.0
Totals	141,861	1,246	0.9

*Asterisks denote fuels not consumed at any of the study buildings at a particular base.

4. Historical Energy Consumption

Figure 2 illustrates the historical trend of energy consumption at Ft. Shafter, Schofield Barracks, and Tripler Army Medical Center. The general trend has been towards decreasing energy consumption.

5. Reevaluated Projects Results

The following ECO's evaluated in the 1981 EEAP basewide study, were reevaluated in the present study, with the listed results:

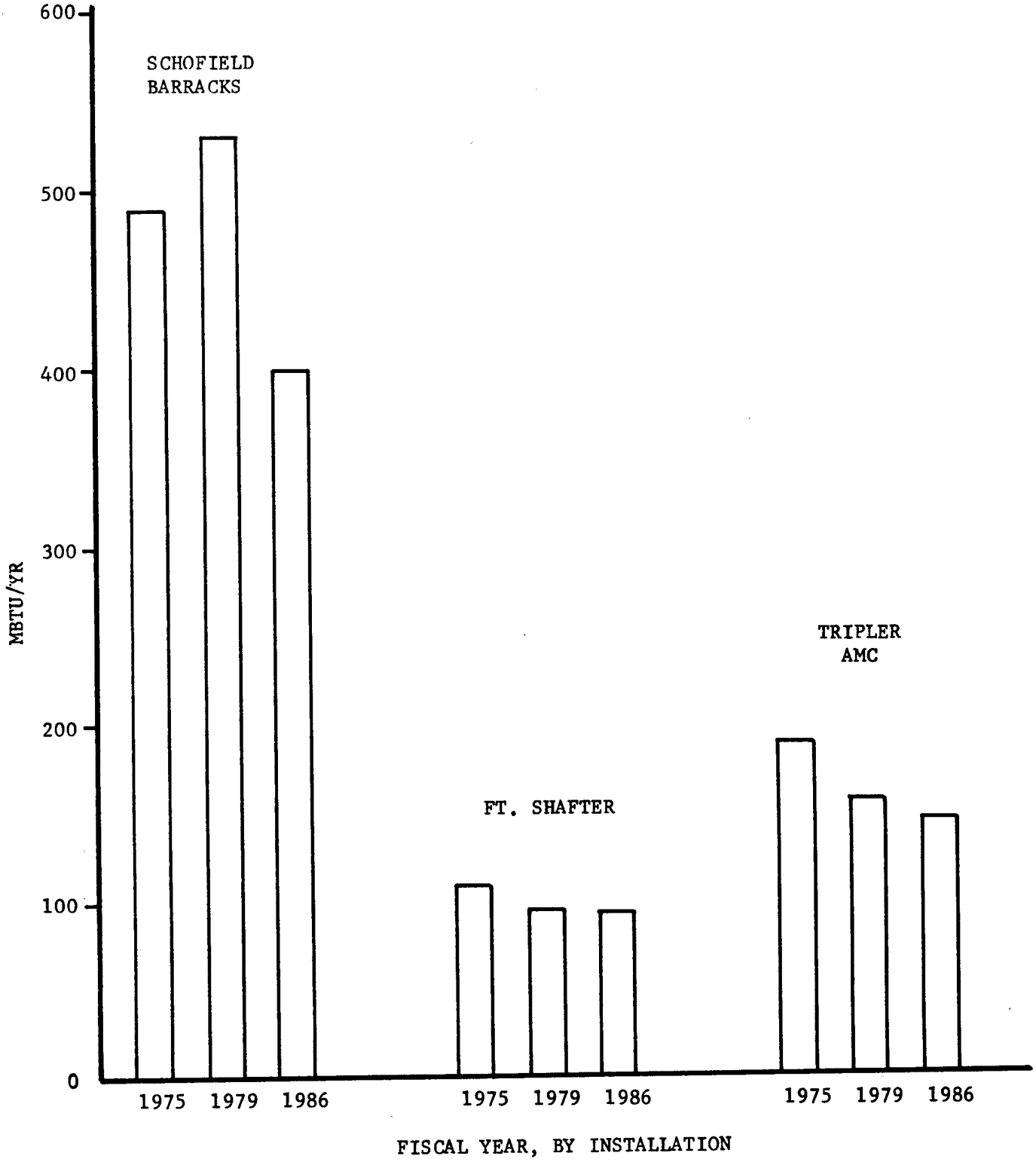
ECO	Previous Study Results (SIR)	This Study Results (SIR)	Recommendation
Exterior Shading Devices, Quad E	1.09	0.34	Reject
Install Heat Pumps, Quad E	2.50	0.12	Reject
Water Flow Restrictors, Quad E	8.06	4.16	Accept
Remove Corridor Fan Coil Units, Quad E	202.00	No analysis required; fan-coil units have been disconnected.	
Chilled Water Loops, Quads C,D,E,F	2.53	No analysis required; project is being implemented in the current fiscal year.	
Chilled Water Loops, Quads I,J,K	5.32	No analysis required; project is being implemented in the current fiscal year.	

6. Energy Conservation Analysis

6.1 ECOs Investigated

General ECO's listed in Annex "A" of the SOW are listed in Table 4. Also included in Table 4 are ECO's not listed in Annex "A", which were identified by the A/E during the field study. Selected ECO's and

FIGURE 2. HISTORICAL ENERGY CONSUMPTION



designated energy considerations listed in Annex "B" of the SOW are listed in Table 5. The designated energy considerations are not specific ECO's. The A/E identified appropriate ECO's whereever applicable which correspond to the energy considerations, and these are listed in the Remarks column of Table 5. Low Cost/No Cost ECO's are listed in Table 6.

6.2 Not Applicable ECOs

The following ECO's were briefly considered, but were not evaluated in detail, because they are not applicable to or not practical in any of the buildings in this study.

- o Building Insulation and Insulated Panels - Temperature gradients between ambient air and conditioned spaces for Hawaii's climate are too small to make U-factor improvement practical.

- o Storm Windows or Double Glazing - Temperature gradients between ambient air and conditioned spaces for Hawaii's climate. are too small to make window U-factor improvement practical.

- o Vestibules - Temperature difference between outside air and conditioned air is too small to make vestibules a feasible retrofit.

- o Load Dock Seals - Receiving areas in the buildings, where they occur, are not air conditioned, so that seals are not necessary.

- o Reduction of Glass Area - Except where direct solar gain through windows occurs, this ECO is not feasible because temperature gradients are too small. In buildings where direct solar gain is a problem, lower cost ECO's were pursued, such as curtains and reflective film.

- o Infrared Heaters - Heating not required in any of the buildings.

- o Economizer Cycles - Utilization of outside air for space cooling not practical because of the warm, humid climate. Relative humidity is very high during the night when dry bulb temperature becomes lower than conditioned space temperature.

TABLE 4. ECO'S INVESTIGATED: GENERAL ECO'S

Reference: Scope of Work, Annex A

GENERAL ECO	FT. SHAFTER BUILDING NUMBER												
	220	500	550	640	660	665	710	715	716	718	1547	1543	40*
Insulation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Storm windows or double glazing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Weatherstripping and caulking	A	A	A	A	A	NA	A	A	A	A	A	NA	A
Insulated panels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Solar films	NA	NA	NA	NA	NA	NA	NA	NA	A	NA	NA	NA	NA
Vestibules	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Load dock seals	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reduction of glass area	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace kitchen light fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shutdown energy to water heaters	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA
Fluorescent lamps	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reduce lighting levels	A	NA	A	NA	NA	A	NA	A	NA	A	NA	A	A
Replace incand-escent lighting	A	A	A	NA	A	NA	NA	A	A	NA	A	NA	A
More efficient lighting source	NA	NA	A	NA	NA	A	NA	NA	NA	NA	NA	NA	NA
Improve power factor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
High efficiency motor replacement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Night setback	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Infrared heaters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Economizer cycles	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	220	500	550	640	660	665	710	715	716	718	1547	1543	40*

TABLE 4. ECO'S INVESTIGATED: GENERAL ECO'S (CONTINUED)

GENERAL ECO	FT. SHAFTER BUILDING NUMBER												
	220	500	550	640	660	665	710	715	716	718	1547	1543	40*
Control hot water circulation pump	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FM radio controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Decentralize domestic water heaters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shower flow restrictors	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heat reclaim from hot refrigerant gas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reduce air flow	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Prevent air stratification	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Install time clocks	NA	NA	A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA
Boiler oxygen trim control	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revise boiler controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chiller replacement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace absorption chiller	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Insulate steam lines	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Return condensate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Domestic hot water heat pumps	NA	NA	NA	NA	NA	A	A	NA	NA	NA	NA	NA	NA
Transformer voltage	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transformer loading	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revise or repair HVAC controls	A	NA	A	A	A	NA	NA	NA	NA	NA	A	A	NA
Waste heat recovery	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	220	500	550	640	660	665	710	715	716	718	1547	1543	40*

Legend: A -- Applicable ECO NA -- Not Applicable ECO
*Note: Bldg.40 is at Tripler AMC.

TABLE 4. ECO'S INVESTIGATED: GENERAL ECO'S (CONTINUED)

GENERAL ECO	FT. SHAFTER BUILDING NUMBER												
	220	500	550	640	660	665	710	715	716	718	1547	1543	40*
Replace Windows	NA	NA	NA	NA	NA	NA	NA	NA	NA	A	NA	NA	NA
Install Curtains	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	NA
Time Clock Bypass Controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A	NA	NA
Insulate Water Heaters	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA
Low-Temp Dishwashers	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace Pipe Insulation	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace Duct Insulation	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mixing Valve	NA	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	NA
Replace Boiler	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A
Switch Fuels	NA	NA	NA	A	A	A	NA	NA	NA	NA	NA	NA	NA
Modify Air Distribution	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thermostat Controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Install Light Switches	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Install Skylights	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace HID With Fluorescent Fixtures	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA
Low-Voltage Lighting Fixtures	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	220	500	550	640	660	665	710	715	716	718	1547	1543	40*

Legend: A -- Applicable ECO NA -- Not Applicable ECO

*Note: Bldg.40 is at Tripler AMC.

TABLE 4. ECO'S INVESTIGATED: GENERAL ECO'S (CONTINUED)

Reference: Scope of Work, Annex A

GENERAL ECO	SCHOFIELD BARRACKS BUILDING NUMBER											
	549	550	552	557	586	660	693	858	859	860	2091	2800
Insulation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Storm windows or double glazing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Weatherstripping and caulking	A	NA	A	A	NA	NA	A	NA	NA	A	NA	NA
Insulated panels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Solar films	NA	NA	NA	A	NA	A	NA	NA	NA	NA	NA	NA
Vestibules	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Load dock seals	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reduction of glass area	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace kitchen light fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shutdown energy to water heaters	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA
Fluorescent lamps	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reduce lighting levels	A	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	NA
Replace incand-escent lighting	A	A	A	A	A	A	A	A	A	A	A	NA
More efficient lighting source	A	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	A
Improve power factor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
High efficiency motor replacement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Night setback	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Infrared heaters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Economizer cycles	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	549	550	552	557	586	660	693	858	859	860	2091	2800

TABLE 4. ECO'S INVESTIGATED: GENERAL ECO'S (CONTINUED)

GENERAL ECO	SCHOFIELD BARRACKS BUILDING NUMBER											
	549	550	552	557	586	660	693	858	859	860	2091	2800
Control hot water circulation pump	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FM radio controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Decentralize domestic water heaters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shower flow restrictors	A	A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heat reclaim from hot refrigerant gas	A	A	A	NA	A	NA	NA	NA	NA	NA	A	NA
Reduce air flow	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Prevent air stratification	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Install time clocks	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	A	NA
Boiler oxygen trim control	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A
Revise boiler controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A
Chiller replacement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace absorption chiller	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Insulate steam lines	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A
Return condensate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Domestic hot water heat pumps	A	A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transformer voltage	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transformer loading	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revise or repair HVAC controls	NA	NA	NA	A	NA	NA	A	NA	NA	NA	NA	NA
	549	550	552	557	586	660	693	858	859	860	2091	2800

Legend: A -- Applicable ECO NA -- Not Applicable ECO

TABLE 4. ECO'S INVESTIGATED: GENERAL ECO'S (CONTINUED)

GENERAL ECO	SCHOFIELD BARRACKS BUILDING NUMBER											
	549	550	552	557	586	660	693	858	859	860	2091	2800
Waste heat recovery	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A
Replace Windows	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Install Curtains	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA
Time Clock Bypass Controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Insulate Water Heaters	NA	NA	NA	A	A	NA	A	NA	NA	NA	A	NA
Low-Temp Dishwashers	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	A	NA
Replace Pipe Insulation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace Duct Insulation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mixing Valve	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Replace Boiler	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Switch Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A	A
Modify Air Distribution	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	NA	NA
Thermostat Controls	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA
Install Light Switches	NA	NA	NA	A	A	NA	NA	NA	NA	NA	NA	NA
Install Skylights	NA	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	A
Replace HID With Fluorescent Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Low-Voltage Lighting Fixtures	NA	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	NA
External Shading Devices	A	A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA
	549	550	552	557	586	660	693	858	859	860	2091	2800

Legend: A -- Applicable ECO NA -- Not Applicable ECO

TABLE 5. SELECTED ECO's LISTED IN ANNEX "B"

Bldg.No.	ECO Description	Remarks
FT. SHAFTER:		
220	Insulate/seal false ceiling over air conditioned space.	Include modification of air distribution in ECO analysis.
ECO's:	Modify Air Distribution: (Two solutions investigated) (A) Ceiling Plenum. Cost = $85,741, energy savings = 55.97 MBTU/yr, SIR = 0.20, SPB = 66.26 years. (B) Underfloor Distribution. Cost = $59,445, energy savings = 55.97 MBTU/yr, SIR = 0.29m SPB = 45.94 years.	
220	State-of-art equipment to regulate humidity, dust, and temperature.	Equipment already exists in areas where control is needed. No ECO analysis is required.
550	Air conditioning controls and economizing the system.	An EMCS system is already programmed for installation. No ECO analysis is required.
640	Microprocessor controls for air conditioning and lights.	An EMCS system is already programmed for installation. No ECO analysis is required.
	Address ramifications of enclosing the top floor and providing air conditioning.	Not an ECO. No ECO analysis is required.
660	Automatic temperature, humidity, and time control.	Humidity control would increase energy use. Temperature and time controls already exist. No ECO analysis is required.
665	Economize use of exhaust system and office air conditioning.	Analyze operational procedures for fans in handball courts. Fans in gym & locker rooms must operate continuously for ventilation. Office A/C is controlled by existing wall thermostat. No ECO analysis is required.
1547	Install automatic time control of air conditioning.	Time clock exists, justs needs new pins. Analyze an ECO for bypass timer switch for evenings/weekends occasional building use.
ECO:	Bypass Timer Controls. Cost = $2,837, energy savings = 78.75 MBTU/yr, SIR = 8.52, SPB = 1.56 years.	
TRIPLER AMC: None		

TABLE 5. SELECTED ECO's LISTED IN ANNEX "B" (CONTINUED)

Bldg.No.	ECO Description	Remarks
SCHOFIELD BARRACKS:		
557	Automatic temperature, humidity, and time control.	Humidity control would increase energy use, existing temperature control is adequate, time control will be provided by EMCS system already programmed for installation. No ECO analysis is required.
660	Analyze existing solar air conditioning system.	Deleted from scope per Clarification memo.
693	Air conditioning controls and economizing the system.	An EMCS system is already programmed for installation. No ECO analysis is required.
2091	Microprocessor controls for air conditioning and lights.	7-day time clocks are a more practical ECO for A/C systems; time control of lights not needed.
ECO:	Time Clock For A/C. Cost = $1,596, energy savings = 55.8 MBTU/yr, SIR = 10.01, SPB = 1.33 years.	
2800	Analyze laundry/dry cleaning process (as modified in Clarification memo).	No operational deficiencies, but there are system inefficiencies (see steam and hot water systems discussion, below). No ECO analysis required.
2800	Conduct lighting investigation; identify fixtures which can be de-lamped.	Evaluate skylight panels ECO. De-lamping rejected: existing light levels are near minimum acceptable levels.
ECO:	Install Skylights. Cost = $$24,145, energy savings = 455.76 MBTU/yr, SIR = 5.41, SPB = 2.45 years.	
2800	Analyze steam and hot water systems	Evaluate following ECO's: 1) Replace Steam Traps, 2) Insulate Steam Fittings 3) Heat Recovery From Dryers
ECO's:	Replace Steam Traps: Cost = $7,975, energy savings = 1,735 MBTU/yr, SIR = 13.34, SPB = 0.85 years. Insulate Steam Fittings: Cost = $7,207, energy savings = 117.57 MBTU/yr, SIR = 1.45, SPB = 11.35 years. Heat Recovery From Dryers (Two solutions investigated): (A) Heat Recovery Plenum: Cost = $47,263, energy savings = 684.88 MBTU/yr, SIR = 1.29, SPB = 12.78 years. (B) Energy Recovery Wheel: Cost = $356,448, energy savings = 3,921 MBTU/yr, SIR = 0.67, SPB = 30.78 years.	

TABLE 5. SELECTED ECO's LISTED IN ANNEX "B" (CONTINUED)

Bldg.No.	ECO Description	Remarks
SCHOFIELD BARRACKS: (CONTINUED)		
2800	Install steam return system	Steam Return System is not practical; existing condensate return is adequate. No ECO analysis is required.
2800	Modify boiler room equipment.	Evaluate following ECO's: 1) Retrofit of boilers with smaller burners. 2) Switch Boiler Fuels 3) Install Water Softener 4) Boiler Oxygen Trim Controls
ECO's:	Replace Burner: Not technically feasible. No LCC analysis made. Switch Boiler Fuels: Cost = $8,595, energy savings = 0 MBTU/yr, SIR = 15.77, SPB = 0.73 years. Install Water Softener. Cost = 5,911, energy savings = 596 MBTU/yr, SIR = 7.92, SPB = 2.21 years. Boiler Oxygen Trim Controls: Cost = $15,164, energy savings = 517 MBTU/yr, SIR = 3.04, SPB = 5.43 years.	
ECO's Previously Evaluated in the 1981 Basewide Study:		
858 859 860	Chilled Water Loop	Project being implemented in the current fiscal year. No ECO analysis required.
549 550 552	Chilled Water Loop	Project being implemented in the current fiscal year. No ECO analysis required.
549 550 552	Install Shading Devices	Reevaluate at current price levels. Cost = $130,839, energy savings = 252.4 MBTU/yr, SIR = 0.34, SPB = 43.45 years.
549 550 552	Install Heat Pumps	Reevaluate at current price levels. Cost = $406,574, energy savings = 2,120 MBTU/yr, SIR = 0.12, SPB = 137.17 years.
549 550 552	Remove Corridor Fan Coil Units	Fan coil units have been disconnected. No ECO analysis required.
549 550 552	Install Water Flow Restrictors	Reevaluate at current price levels. Cost = $ 12,228, energy savings = 484 MBTU/yr, SIR = 4.16, SPB = 4.06 years.

TABLE 6. LOW COST/NO COST ECO's

ECO Description FT. SHAFTER AND TRIPLER AMC	Bldg No. (ECO Applicable To Building Indicated By an "x") 220	500	550	640	660	665	710	715	716	718	1543	1547	40*
Increase Efficiency of Air-Conditioning and Ventilating Systems													
Raise room thermostat set-points.	x	x	x	x						x		x	
Set or re-set existing installed time clock control.	x		x	x								x	
Install reflective film on windows									x				
Increase Efficiency of Domestic Hot Water Systems													
Insulate hot water piping.								x					
Shut down energy to water heaters or modify controls.					x								
Increase Efficiency of Lighting Systems													
De-lamp fluorescent fixtures to reduce excessive lighting levels.	x		x			x		x		x	x		x
Modify light switch controls.					x								
	220	500	550	640	660	665	710	715	716	718	1543	1547	40*

TABLE 6. LOW COST/NO COST ECO's (CONTINUED)

ECO Description	Bldg No. (ECO Applicable To Building Indicated By an "x")											
SCHOFIELD BARRACKS	549	550	552	557	586	660	693	858	859	860	2091	2800
Increase Efficiency of Air-Conditioning and Ventilating Systems												
Raise room thermostat set-points.	x	x	x			x	x	x	x	x	x	
Set or re-set existing installed time clock control.						x	x					
Install reflective film on windows.				x								
Install curtains on windows.	x											
Increase Efficiency of Domestic Hot Water Systems												
Lower thermostat settings on domestic water heaters to 120°F.				x								
Insulate hot water piping.				x	x		x				x	x
Shut down energy to water heaters or modify controls.				x								
Shut off HW supply to lavs.	x											
Increase Efficiency of Lighting Systems												
De-lamp lighting fixtures to reduce excessive lighting levels.							x				x	
Remove selective fluorescent fixtures to reduce lighting levels.	x											
Replace lamps with lower wattage lamps.					x							
	549	550	552	557	586	660	693	858	859	860	2091	2800

- o Control Hot Water Circulation Pump - Heating systems not required in any of the buildings.

- o FM Radio Controls - Radio control of building energy systems is not practical for small buildings such as those in this study.

- o Decentralize Domestic Hot Water Heaters - Domestic hot water systems are already de-centralized in buildings where this would save energy. For other buildings, such as the Quads (barracks), decentralization offers no advantage because DHW fixtures are widely distributed throughout the building, and energy savings would be offset by greatly increased maintenance of multiple water heaters.

- o Prevent Air Stratification - Generally not a problem in air conditioned spaces, because the volume of supply air and the manner of its distribution ensures good vertical circulation.

- o Reduce Air Flow - Reduction of air flow would reduce the amount of energy consumed by fans. However, unless the fan-coil units are replaced, air flow reduction would result in colder, lower-velocity supply air. Existing room air devices would not distribute air as efficiently as originally designed, and would also have to be replaced. Fans would operate at less efficient points on their operating curve. Modifications to existing systems would be extensive, in return for relatively modest energy savings. No instances of excessive air conditioned volumes were identified in any of the buildings.

- o Chiller Replacement - Chiller replacement cannot be justified based on energy savings due to the large cost of replacement.

- o Replace Absorption Chiller - Similar reasoning as above. Only one absorption chiller exists among the buildings surveyed in this study.

- o Insulate Steam Lines - Only one building (Bldg. 40, TAMC) has steam lines, but these are already insulated.

- o Replace Kitchen Light Fixtures - Field surveys showed that energy-efficient fluorescent fixtures are installed in kitchens. There is no apparent physical deterioration of the fixtures, and lighting levels

are within DOD standards (maximum 70 foot-candles). It was concluded that significant cost savings could not be obtained with alternate lighting systems.

- o Energy-Conserving Fluorescent Lamps: Field surveys found that this type of lamp is now being regularly stocked by the facility maintenance departments for replacement of regular wattage lamps as the existing lamps expire.

- o Improve Power Factor - Power factors for this installation have been previously addressed and improvements made.

- o High Efficiency Motor Replacement - In discussions with the PODED-MP, it was agreed that the establishment of energy savings would have required kilowatt-hour and amperage metering over daily or weekly operating cycles. Given the limited field survey scope, and the existence of primarily small-horsepower motors in the designated buildings, for which rapid payback is not expected, this ECO will not be investigated at this time.

- o Night Setback/Setup Thermostats - Of the buildings surveyed, only Bldg. 220, Ft. Shafter required 24-hour space cooling, for ADP equipment. Equipment has a certain temperature requirement, which should not be set back.

- o Transformer Overvoltage and Loading - By clarification to the Contract Scope of Work, these items will not be analyzed in this study.

- o Return Condensate - The steam generators are already equipped with a condensate return system.

6.3 Life Cycle Analysis of ECO's

Table 7 summarizes the results of the life cycle analysis of identified ECO's. Listed are all ECO's for which a life cycle analysis was performed. The ECO's are grouped by installation, and within each group are listed in order from increasing to decreasing SIR.

6.4 No Cost/Low Cost ECO's

Table 8 lists the No Cost/Low Cost ECO's along with their implementation costs and energy savings.

6.5 Operation and Maintenance Recommendations

Operation and maintenance recommendations are procedures that were identified for specific buildings, but which may be applicable to other buildings not covered by this study. Although the energy savings are impossible to define, the implementation of these recommendations is important to maintaining efficient energy use. Table 9 lists the operation and maintenance recommendations at specific buildings, identified during the field survey.

TABLE 7. LIFE CYCLE COST ANALYSIS RESULTS FOR ECO'S

Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Type	Energy Savings Amount (MBTU/Yr)	Annual Dollar Savings	SIR	Simple Payback Period
FT. SHAFTER AND TRIPLER AMC:							
220	Fluorescent Light Fixtures	$ 284	Elec	4.54	$ 275	12.49	.98
1547	Bypass Timer Controls	$ 2,837	Elec	78.75	$ 1,730	8.52	1.56
640	Timeclocks (Lights)	$ 471	Elec	11.72	$ 264	7.80	1.70
665	Switch Fuels, SNG to Oil	$ 25,138	--	0.00	$ 8,068	6.31	2.96
660	Insulate Water Heater	$ 95	Elec	1.33	$ 29	4.31	3.08
550	Timeclocks (Lights)	$ 942	Elec	8.20	$ 415	3.55	2.16
665	Install Heat Pumps for DHW	$ 37,960	SNG	836.33	$ 8,840	3.20	4.08
550	Low-Voltage Lighting Fixtures	$ 9,988	Elec	58.85	$ 2,545	2.40	3.73
665	Replace HID W/Fluorescent Fixt	$ 12,744	Elec	58.23	$ 1,510	1.62	8.02
710	Mixing Valve For DHW System	$ 668	Oil	9.99	$ 59	1.57	10.74
550	Skylight Panels	$ 8,652	Elec	40.24	$ 884	1.43	9.30
715	HPS Lighting Fixtures	$ 1,574	Elec	5.01	$ 553	1.30	2.70
40[2]	HPS Lighting Fixtures	$ 1,513	Elec	4.61	$ 148	1.20	9.74
716	HPS Lighting Fixtures	$ 631	Elec	1.84	$ 100	1.19	5.98
550	Replace Pipe Insulation	$ 8,082	Elec	29.71	$ 653	1.13	11.77
550	HPS Lighting Fixtures	$ 2,583	Elec	6.59	$ 1,438	1.04	1.71
220	Replace Duct Insulation	$ 62,370	Elec	207.81	$ 4,566	1.02	12.98
640	Switch Fuels For Water Heater	$ 5,349	Elec	0.00	$ 358	.82	14.18
1547	HPS Lighting Fixtures	$ 631	Elec	1.03	$ 139	.67	4.30
660	Switch Fuels For Water Heater	$ 5,225	Elec	0.00	$ 281	.65	17.69
640	Low-Temperature Dishwashers	$ 8,508	Elec	19.04	$ 411	.51	19.68
710	Install Heat Pumps for DHW	$ 6,588	Oil	86.78	$ 200	.46	31.32
718	Replace Jalousie Windows	$ 10,734	Elec	13.33	$ 293	.45	29.36
640	Install Curtains	$ 21,552	Elec	28.28	$ 621	.40	32.96
220	Modify Air Distribution ("B")	$ 59,445	Elec	55.97	$ 1,230	.29	45.94
500	HPS Lighting Fixtures	$ 5,574	Elec	3.61	$ 726	.26	7.30
220	Modify Air Distribution ("A")	$ 85,741	Elec	55.97	$ 1,230	.20	66.26
40[2]	Replace Steam Boiler	$ 24,694	Oil	30.04	$ 2,112	.02	11.11

NOTES:
1. Analysis Date 1986.
2. Building 40 at Tripler Army Medical Center. All others Ft. Shafter.

TABLE 7. LIFE CYCLE COST ANALYSIS RESULTS FOR ECO'S (CONTINUED)

Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Amount Type	(MBTU/Yr)	Annual Dollar Savings	SIR	Simple Payback Period
SCHOFIELD BARRACKS:							
2800	Switch Boiler Fuels	$ 8,595	--	0.00	$11,241	15.77	.73
2800	Replace Steam Traps	$ 7,975	Oil	1,735.00	$ 8,901	13.34	.85
557	Thermostatic Controls	$ 899	Elec	48.52	$ 995	11.68	.86
2091	Time Clock For A/C	$ 1,596	Elec	55.80	$ 1,144	10.01	1.33
2800	Install Water Softener	$ 5,911	Oil	596.00	$ 2,539	7.92	2.21
557	Install Light Switches	$ 1,328	Elec	23.84	$ 531	5.53	2.38
2800	Install Skylight Panels	$ 24,145	Elec	455.76	$ 9,348	5.41	2.45
550	Heat Recovery From A/C for DHW	$ 15,052	Oil	635.28	$ 3,537	4.26	4.04
552	Heat Recovery From A/C for DHW	$ 15,052	Oil	635.28	$ 3,537	4.26	4.04
549,550,552	Flow Restrictors	$ 12,228	Oil	484.00	$ 2,860	4.16	4.06
586	Time Clock For A/C	$ 665	Elec	9.54	$ 196	4.11	3.23
550	Low-Temperature Dishwashers	$ 8,508	Elec	130.84	$ 2,627	3.26	3.08
2800	Boiler Oxygen Trim Controls	$ 15,164	Oil	517.00	$ 2,652	3.04	5.43
586	Insulate Water Heater	$ 140	Elec	1.42	$ 29	2.91	4.56
693	Insulate Water Heaters	$ 654	Elec	6.13	$ 126	2.69	4.94
2091	Insulate Water Heater	$ 140	Elec	1.23	$ 25	2.52	5.26
557	Insulate Water Heaters	$ 407	Elec	3.46	$ 71	2.43	5.46
549	Heat Recovery From A/C for DHW	$ 15,052	Oil	354.69	$ 1,879	2.30	7.61
586	Heat Recovery From A/C for DHW	$ 9,675	Elec	68.11	$ 1,397	2.02	6.58
586	HPS Lighting Fixtures	$ 1,307	Elec	6.91	$ 380	2.01	3.26
693	Low-Voltage Lighting Fixtures	$ 5,835	Elec	27.45	$ 1,147	1.79	4.83
2800	Insulate Steam Fittings	$ 7,207	Oil	117.57	$ 603	1.45	11.35
2800	Heat Recovery From Dryers ("A")	$ 47,263	Oil	684.88	$ 3,513	1.29	12.78
557	HPS Lighting Fixtures	$ 1,695	Elec	4.60	$ 244	1.03	6.60
2091	HPS Lighting Fixtures	$ 2,227	Elec	5.43	$ 489	0.93	4.33
557	Fluorescent Lighting Fixtures	$ 1,057	Elec	1.88	$ 66	.83	15.20
2091	Heat Recovery From A/C for DHW	$ 16,823	Oil	135.78	$ 776	.83	20.59
2800	Heat Recovery From Dryers ("B")	$ 356,448	Oil	3,921.30	$11,006	.67	30.78
2091	Switch Fuels For Water Heating	$ 5,392	Elec	0.00	$ 283	.63	18.13
660	Modify Air Distribution	$ 1,602	Elec	3.43	$ 70	.61	21.64

Analysis Date 1986.

TABLE 7. LIFE CYCLE COST ANALYSIS RESULTS FOR ECO'S (CONTINUED)

Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Type	Energy Savings Amount (MBTU/Yr)	Annual Dollar Savings	SIR	Simple Payback Period
586	Install Light Switches	$ 1,865	Elec	3.41	$ 77	.57	22.89
693	Install Skylight Panels	$ 24,706	Elec	48.69	$ 999	.56	23.51
2091	Low-Temperature Dishwashers	$ 8,508	Elec	17.59	$ 353	.44	22.89
549,550,552	Exterior Shading Devices	$ 130,839	Elec	252.40	$ 2,862	.34	43.45
586	Install Window Curtains	$ 1,204	Elec	1.11	$ 23	.26	50.25
549,550,552	Install Heat Pumps	$ 406,574	Oil	2,120.00	$ 2,817	.12	137.17
860	Fluorescent Lighting Fixtures	$ 59,854	Elec	9.59	$ 778	.06	73.14
858	Fluorescent Lighting Fixtures	$ 69,876	Elec	9.72	$ 788	.05	84.22
550	Fluorescent Lighting Fixtures	$ 80,527	Elec	11.11	$ 901	.05	84.92
859	Fluorescent Lighting Fixtures	$ 92,547	Elec	12.61	$ 1,023	.05	86.00
549	Fluorescent Lighting Fixtures	$ 72,254	Elec	6.60	$ 492	.03	139.45
552	Fluorescent Lighting Fixtures	$ 80,527	Elec	6.66	$ 540	.03	141.57

Analysis Date 1986.

TABLE 8. LOW COST/NO COST PROJECT SUMMARY

Project Description	Bldg. No.	Energy Type	Savings (MBTU/Yr)	Annual Dollar Savings	Material Cost ($)	Job Trade	Man-Hours	Labor Cost($)	Total Cost($)
FT. SHAFTER AND TRIPLER AMC									
Raise room thermostat set-points.	220	Elec	29.41	646	0	HVAC Tech	2.00	84	84
	500	Elec	5.04	110	0	HVAC Tech	.25	11	11
	550	Elec	31.44	691	0	HVAC Tech	1.00	42	42
	640	Elec	8.90	196	0	HVAC Tech	1.25	53	53
	718	Elec	6.78	149	0	HVAC Tech	1.00	42	42
	1547	Elec	7.31	161	0	HVAC Tech	.50	21	21
Install reflective film on windows.	716	Elec	3.99	88	64	Glazier	3.80	134	198
Set or re-set existing installed time clock control.	220	Elec	2.21	49	0	HVAC Tech	.50	21	21
	550	Elec	76.04	1671	0	HVAC Tech	.50	21	21
	640	Elec	11.69	257	0	HVAC Tech	.50	21	21
	1547	Elec	27.95	614	2	HVAC Tech	.50	21	23
Insulate hot water piping.	715	SNG	8.89	118	162	Plumber	6.75	298	460
Shut down energy to water heater	660	SNG	14.25	189	25	Plumber	1.75	77	102
De-lamp fluorescent fixtures to reduce excessive lighting levels	220	Elec	2.39	53	0	Electr.	.30	13	13
	550	Elec	16.50	362	0	Electr.	4.65	195	195
	665	Elec	17.16	377	0	Electr.	1.95	82	82
	715	Elec	1.53	34	0	Electr.	.60	25	25
	718	Elec	7.62	167	0	Electr.	2.40	101	101
	1543	Elec	6.74	148	0	Electr.	.75	32	32
	40*	Elec	6.81	145	0	Electr.	.60	25	25
Modify light switch controls.	660	Elec	0.31	6	138	Electr.	2.50	105	243
TOTALS			292.96	6231	389			1424	1815

* Building 40 at Tripler AMC; all others at Ft. Shafter.

TABLE 8. LOW COST/NO COST PROJECT SUMMARY (CONTINUED)
SCHOFIELD BARRACKS

Project Description	Bldg. No.	Energy Type	Savings (MBTU/Yr)	Annual Dollar Savings	Material Cost ($)	Job Trade	Man-Hours Hours	Labor Cost($)	Total Cost($)
Raise room thermostat set-points.	549	Elec	21.61	443	0	HVAC Tech	6.00	252	252
	550	Elec	2.94	60	0	HVAC Tech	0.50	21	21
	552	Elec	0.67	14	0	HVAC Tech	0.50	21	21
	660	Oil	5.90	35	0	HVAC Tech	8.25	346	346
	693	Elec	20.52	421	0	HVAC Tech	1.25	52	52
	858	Elec	0.87	18	0	HVAC Tech	0.75	32	32
	859	Elec	11.87	243	0	HVAC Tech	9.00	378	378
	860	Elec	17.81	365	0	HVAC Tech	0.50	21	21
	2091	Elec	3.42	70	0	HVAC Tech	0.50	21	21
Set or re-set existing installed time clock control.	660	Oil	40.00	236	0	HVAC Tech	0.50	21	21
	693	Elec	94.46	1937	0	HVAC Tech	0.50	21	21
Install reflective film on windows.	557	Elec	1.63	33	42	Glazier	2.50	88	130
Install blinds on windows.	549	Elec	2.10	43	393	Carpenter	1.50	57	450
Lower thermostat settings on domestic water heaters to 120°F.	557	Elec	1.20	25	0	Electr.	0.25	11	11
Insulate hot water piping.	557	Elec	3.84	79	54	Plumber	2.25	99	153
	586	Elec	5.29	108	44	Plumber	1.60	70	114
	693	Elec	2.13	44	48	Plumber	2.00	88	136
	2091	Elec	1.15	24	24	Plumber	1.00	44	68
	2800	Oil	50.79	261	260	Plumber	5.42	238	498
Shut down energy to water heaters.	557	Elec	1.32	27	0	Electr.	0.50	21	21
Shut off HW supply to lavs.	549	Oil	7.58	45	0	Plumber	1.00	44	44
De-lamp lighting fixtures to reduce excessive lighting levels	693	Elec	66.89	1372	0	Electr.	16.20	683	683
	2091	Elec	8.05	165	0	Electr.	1.80	76	76
Remove selective fluorescent fixtures.	549	Elec	6.46	132	40	Electr.	3.20	135	175
Replace lamps with lower wattage lamps.	586	Elec	12.55	257	17	Electr.	1.40	59	76
TOTALS			391.05	6457	922			2899	3821

TABLE 9. OPERATION AND MAINTENANCE RECOMMENDATIONS

Recommendation	Bldg No. (Recommendation Applicable To Building Indicated By an "x")												
FT. SHAFTER AND TRIPLER AMC	220	500	550	640	660	665	710	715	716	718	1543	1547	40*
1. Seal gaps between wall and window-type A/C units (caulking, weatherstripping, repair, etc.).							x	x					x
2. Install or repair weather-stripping on doors and windows.	x	x	x	x	x			x		x		x	
3. Install threshold beneath door.								x	x				
4. Repair/recalibrate A/C controls.	x	x	x	x	x						x		
5. Repair/adjust A/C unit.	x												
6. Purge cooling water system.	x												
7. Keep stage curtains closed when stage not in use.		x											
8. Repair leaking drain valve.				x									
9. Repair supply plenum of AHU.				x									
10. Correct chiller sweating condition.				x									
11. Re-locate compressor.				x									
12. Turn off lights when not needed.				x									
13. Repair broken dimmer switches.				x									
14. Turn off kitchen hood fans when not using cooking equipment.				x			x	x					
15. Replace broken timeclock.					x								
16. Place ID labels on fan switches.						x							
17. Replace broken thermostat.						x							
18. Shut off supply air device.						x							
19. Keep door closed whenever possible.						x							
20. Repair insulation on HW tank.							x						
21. Replace CHW piping insulation.				x									
22. Clean filter on window A/C unit.							x		x				x
23. Repair fins on window A/C unit.							x						
24. Replace broken equipment gages.												x	
25. Clean light fixtures and lamps.													x
	220	500	550	640	660	665	710	715	716	718	1543	1547	40*

TABLE 9. OPERATION AND MAINTENANCE RECOMMENDATIONS (CONTINUED)

Recommendation	Bldg No. (Recommendation Applicable To Building Indicated By an "x")											
SCHOFIELD BARRACKS	549	550	552	557	586	660	693	858	859	860	2091	2800
1. Install or repair weather-stripping on doors and windows.	x			x			x					
2. Install threshold beneath door.	x		x							x		
3. Repair/recalibrate A/C controls.	x	x	x	x			x	x	x	x		
4. Relocate thermostat.								x	x	x		
5. Repair water heater port cover.		x							x	x		
6. Re-set time clock on HW system.								x	x	x		
7. Adjust door to close tightly.						x						
8. Repair hot water or steam leak.						x			x			x
9. Repair exhaust vent duct.												x
10. Repair chemical feed pump.												x
11. Install lockable guards on t-stats.											x	
12. Turn off kitchen hood fans when not using cooking equipment.											x	
13. Place ID labels on switches.							x					
14. Shut off supply air device.						x	x					
15. Service chilled water system.	x	x	x				x	x	x	x		
16. Repair insulation on steam/HW pipes.												x
17. Service solar water heating system.						x						
18. Install steam flow integrator.												x
19. Clean out condensate drain.							x					
20. Install auto drain on compressor.							x					
21. Clean/replace filter on A/C unit.					x		x				x	
22. Clean chiller condenser fins.								x	x	x		
23. Vent window A/C units to exterior.											x	
	549	550	552	557	586	660	693	858	859	860	2091	2800

7. Conclusions and Recommendations

7.1 General

This section summarizes the results of this EEAP study conducted at USASCH installations. Specific projects that were developed are described in a plan for implementing the ECO's recommended in this study. Also, the effect of the developed projects on energy consumption at Ft. Shafter, Schofield Barracks, and Tripler AMC is illustrated.

7.2 Implementation Plan

The implementation plan recommends, based on guidance from the using agency, the packaging of projects into one ECIP project, one QRIP project, and one PECIP project. There are also nine ECO's with SIR greater than 1.0, which do not fit into any project categories, and which have therefore not been programmed. Table 10 lists the recommended projects, along with their associated economics, and the total energy and cost savings due to implementation of the projects. The schedule of implementation is indicated in Table 10 by the Fiscal Year in which each project would be implemented. It is also recommended that the No Cost/Low Cost ECO's listed in Table 8 be implemented by facility personnel during FY-1987.

7.3 Non-Feasible ECO's

In Table 11 are listed non-feasible ECO's along with their associated economics. Currently non-feasible ECO's may be reconsidered in the future. The trend of stable energy prices may eventually change, and higher prices could make many of these potential ECO's feasible. Also, technology improvements could result in more efficient equipment, and result in a more economical solution to a particular energy problem.

7.4 Impact on Energy Consumption and Costs

Figure 3 shows the impact of the energy savings of the recommended projects on the current energy consumption at Ft. Shafter, Schofield Barracks, and Tripler AMC. Upon implementation of the recommended projects, energy consumption will be reduced as follows:

		ANNUAL ENERGY SAVINGS		
			Percentage Reduction	
				Buildings
		MBTU	Basewide	This Study
Ft. Shafter:	Electricity	517.5	0.68	10.4
	No.2 Oil	10.0	0.16	2.4
	SNG	836.3	10.4	100.0
	All Sources	1,363.8	1.5	21.8
Schofield Barracks:	Electricity	849.0	0.26	5.2
	No.2 Oil	2,109.2	6.9	44.2
	No.5 Oil	3,650.5	19.5	19.5
	LPG	0	0	0
	All Sources	6,608.7	1.7	16.6
Tripler AMC:	Electricity	4.6	0.005	0.41
	No.2 Oil	30.0	1.5	22.4
	No.5 Oil	0	0	0
	All Sources	34.6	0.024	2.8
All Buildings This Study		8,007.2	1.3	16.9

The cost impact of implementation of the recommended projects will be to reduce annual energy costs, and material and labor costs related to energy systems, by a total of $95,065.

TABLE 10. RECOMMENDED PROJECT SUMMARY

Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Type	Energy Savings Amount (MBTU/Yr)	Dollar Savings	SIR	Simple Payback Period	Program Year Cost + SIOH
ECIP PROJECTS								
1. ECIP - FACILITY ENERGY IMPROVEMENTS: (PROGRAMMED YEAR FY 1990)								
Ft. Shafter Buildings:								
220	Fluorescent Light Fixt.	$ 284	Elec	4.54	$ 275	12.49	.98	$ 324
1547	Bypass Timer Controls	$ 2,837	Elec	78.75	$ 1,730	8.52	1.56	$ 3,234
640	Timeclocks (Lights)	$ 471	Elec	11.72	$ 264	7.80	1.70	$ 536
660	Insulate Water Heater	$ 95	Elec	1.33	$ 29	4.31	3.08	$ 108
550	Timeclocks (Lights)	$ 942	Elec	8.20	$ 415	3.55	2.16	$ 1,074
665	Install Heat Pumps	$ 37,960	SNG	836.33	$ 8,840	3.20	4.08	$ 43,275
550	Low-Volt Lighting Fixt.	$ 9,988	Elec	58.85	$ 2,545	2.40	3.73	$ 11,386
665	Replace HID W/Fluorescent	$ 12,744	Elec	58.23	$ 1,510	1.62	8.02	$ 14,529
550	Skylight Panels	$ 8,652	Elec	40.24	$ 884	1.43	9.30	$ 9,862
715	HPS Lighting Fixtures	$ 1,574	Elec	5.01	$ 553	1.30	2.70	$ 1,794
716	HPS Lighting Fixtures	$ 631	Elec	1.84	$ 100	1.19	5.98	$ 719
550	HPS Lighting Fixtures	$ 2,583	Elec	6.59	$ 1,438	1.04	1.71	$ 2,944
Tripler AMC Buildings:								
40[2]	HPS Lighting Fixtures	$ 1,513	Elec	4.61	$ 148	1.20	9.74	$ 1,724
Schofield Barracks Buildings:								
2800	Replace Steam Traps	$ 7,975	Oil	1,735.00	$ 8,901	13.34	.85	$ 9,092
557	Thermostatic Controls	$ 899	Elec	48.52	$ 995	11.68	.86	$ 1,024
2091	Time Clock For A/C	$ 1,596	Elec	55.80	$ 1,144	10.01	1.33	$ 1,820
2800	Install Water Softener	$ 5,911	Oil	596.00	$ 2,539	7.92	2.21	$ 6,739
557	Install Light Switches	$ 1,328	Elec	23.84	$ 531	5.53	2.38	$ 1,514
2800	Install Skylight Panels	$ 24,145	Elec	455.76	$ 9,348	5.41	2.45	$ 27,524
550	Heat Recovery From A/C	$ 15,052	Oil	635.28	$ 3,537	4.26	4.04	$ 17,160
552	Heat Recovery From A/C	$ 15,052	Oil	635.28	$ 3,537	4.26	4.04	$ 17,160

Analysis Date: 1986.

TABLE 10. RECOMMENDED PROJECT SUMMARY (CONTINUED)

Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Type	Energy Savings Amount (MBTU/Yr)	Dollar Savings	SIR	Simple Payback Period	Program Year Cost + SIOH
1. ECIP - FACILITY ENERGY IMPROVEMENTS (CONTINUED)								
549,550,552	Flow Restrictors	$ 12,228	Oil	484.00	$ 2,860	4.16	4.06	$ 13,942
586	Time Clock For A/C	$ 665	Elec	9.54	$ 196	4.11	3.23	$ 759
550	Low-Temp Dishwashers	$ 8,508	Elec	130.84	$ 2,627	3.26	3.08	$ 9,699
2800	Boiler Oxygen Controls	$ 15,164	Oil	517.00	$ 2,652	3.04	5.43	$ 17,287
586	Insulate Water Heater	$ 140	Elec	1.42	$ 29	2.91	4.56	$ 159
693	Insulate Water Heaters	$ 654	Elec	6.13	$ 126	2.69	4.94	$ 745
2091	Insulate Water Heater	$ 140	Elec	1.23	$ 25	2.52	5.26	$ 159
557	Insulate Water Heaters	$ 407	Elec	3.46	$ 71	2.43	5.46	$ 464
549	Heat Recovery From A/C	$ 15,052	Oil	354.69	$ 1,879	2.30	7.61	$ 17,160
586	Heat Recovery From A/C	$ 9,675	Elec	68.11	$ 1,397	2.02	6.58	$ 11,030
586	HPS Lighting Fixtures	$ 1,307	Elec	6.91	$ 380	2.01	3.26	$ 1,490
693	Low-Volt Light Fixtures	$ 5,835	Elec	27.45	$ 1,147	1.79	4.83	$ 6,652
557	HPS Lighting Fixtures	$ 1,695	Elec	4.60	$ 244	1.03	6.60	$ 1,933
TOTALS FOR ECIP PROJECT		$ 223,702		6,917.10	$ 62,896	4.65	3.38	$ 255,021
NON-ECIP PROJECTS								
2. PECIP: Switch Fuels, Bldg. 665, Ft.Shafter (PROGRAMMED YEAR FY 1988)								
665	Switch Fuels, SNG to Oil	$ 25,138	--	0.00	$ 8,068	6.31	2.96	$ 27,148
3. QRIP: Switch Fuels, Bldg. 2800, Schofield Barracks (PROGRAMMED YEAR FY 1988)								
2800	Switch Boiler Fuels	$ 8,595	--	0.00	$ 11,241	15.77	.73	$ 9,283
TOTALS FOR NON-ECIP PROJECTS:		$ 33,733		0.00	$ 19,309	--	--	$ 36,431

Analysis Date: 1986

TABLE 10. RECOMMENDED PROJECT SUMMARY (CONTINUED)

Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Type	Energy Savings Amount (MBTU/Yr)	Dollar Savings	SIR	Simple Payback Period	Program Year Cost + SIOH
OTHER PROJECTS: (NOT PROGRAMMED)								
4. Projects For Which SIR Exceeds 1.0 But SPB Exceeds 10.0 Years:								
	Ft. Shafter Buildings:							
710	Mixing Valve For DHW	$ 668	Oil	9.99	$ 59	1.57	10.74	--
550	Replace Pipe Insulation	$ 8,082	Elec	29.71	$ 653	1.13	11.77	--
220	Replace Duct Insulation	$ 62,370	Elec	207.81	$ 4,566	1.02	12.98	--
	Schofield Barracks Buildings:							
2800	Insulate Steam Fittings	$ 7,207	Oil	117.57	$ 603	1.45	11.35	--
2800	Heat Recovery (Option "A")	$ 47,263	Oil	684.88	$ 3,513	1.29	12.78	--
	Subtotals	$ 125,590		1,049.96	$ 9,394	--	--	--
5. Projects For Which SIR Exceeds 1.0 When 100% of Non-Energy Savings are Credited:								
	Ft. Shafter Buildings:							
1547	HPS Lighting Fixtures	$ 631	Elec	1.03	$ 139	2.77	4.30	--
500	HPS Lighting Fixtures	$ 726	Elec	3.61	$ 726	1.62	7.30	--
	Tripler AMC Buildings:							
40	Replace Steam Boiler	$ 24,694	Oil	30.04	$ 2,112	1.09	11.11	--
	Schofield Barracks Buildings:							
2091	HPS Lighting Fixtures	$ 2,227	Elec	5.43	$ 489	2.78	4.33	--
	Subtotals	$ 28,278		40.11	$ 3,466	--	--	--
TOTALS FOR OTHER PROJECTS:		$ 153,868		1,090.07	$ 12,860	--	--	--
GRAND TOTALS, ALL PROJECTS:		$ 411,303		8,007.17	$ 95,065	--	--	--

Analysis Date: 1986

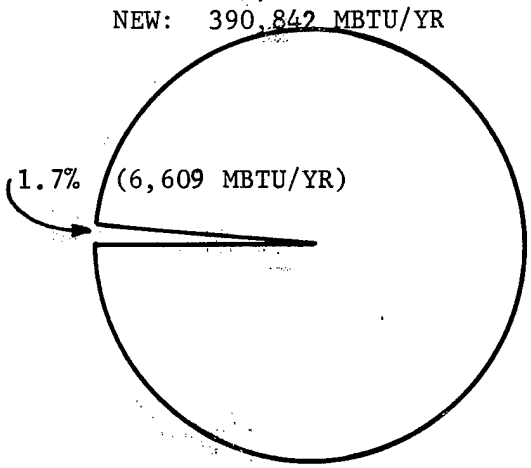
TABLE 11. NON-FEASIBLE ECO'S

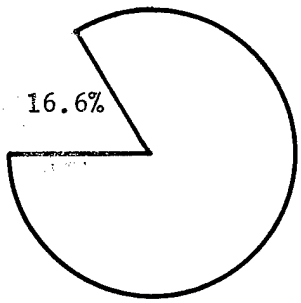
Bldg. No.	ECO Description	Construction Cost + SIOH	Energy Savings Type	Energy Savings Amount (MBTU/Yr)	Annual Dollar Savings	SIR	Simple Payback Period
Ft. Shafter Buildings:							
640	Switch Fuels For Water Heater	$ 5,349	Elec	0.00	$ 358	.82	14.18
660	Switch Fuels For Water Heater	$ 5,225	Elec	0.00	$ 281	.65	17.69
640	Low-Temperature Dishwashers	$ 8,508	Elec	19.04	$ 411	.51	19.68
710	Install Heat Pumps for DHW	$ 6,588	Oil	86.78	$ 200	.46	31.32
718	Replace Jalousie Windows	$ 10,734	Elec	13.33	$ 293	.45	29.36
640	Install Curtains	$ 21,552	Elec	28.28	$ 621	.40	32.96
220	Modify Air Distribution ("B")	$ 59,445	Elec	55.97	$ 1,230	.29	45.94
220	Modify Air Distribution ("A")	$ 85,741	Elec	55.97	$ 1,230	.20	66.26
Schofield Barracks Buildings:							
557	Fluorescent Lighting Fixtures	$ 1,057	Elec	1.88	$ 66	.83	15.20
2091	Heat Recovery From A/C for DHW	$ 16,823	Oil	135.78	$ 776	.83	20.59
2800	Heat Recovery From Dryers ("B")	$ 356,448	Oil	3,921.30	$11,006	.67	30.78
2091	Switch Fuels For Water Heating	$ 5,392	Elec	0.00	$ 283	.63	18.13
660	Modify Air Distribution	$ 1,602	Elec	3.43	$ 70	.61	21.64
586	Install Light Switches	$ 1,865	Elec	3.41	$ 77	.57	22.89
693	Install Skylight Panels	$ 24,706	Elec	48.69	$ 999	.56	23.51
2091	Low-Temperature Dishwashers	$ 8,508	Elec	17.59	$ 353	.44	22.89
549,550,552	Exterior Shading Devices	$ 130,839	Elec	252.40	$ 2,862	.34	43.45
586	Install Window Curtains	$ 1,204	Elec	1.11	$ 23	.26	50.25
549,550,552	Install Heat Pumps	$ 406,574	Oil	2,120.00	$ 2,817	.12	137.17
860	Fluorescent Lighting Fixtures	$ 59,854	Elec	9.59	$ 778	.06	73.14
858	Fluorescent Lighting Fixtures	$ 69,876	Elec	9.72	$ 788	.05	84.22
550	Fluorescent Lighting Fixtures	$ 80,527	Elec	11.11	$ 901	.05	84.92
859	Fluorescent Lighting Fixtures	$ 92,547	Elec	12.61	$ 1,023	.05	86.00
549	Fluorescent Lighting Fixtures	$ 72,254	Elec	6.60	$ 492	.03	139.45
552	Fluorescent Lighting Fixtures	$ 80,527	Elec	6.66	$ 540	.03	141.57

Analysis Date: 1986

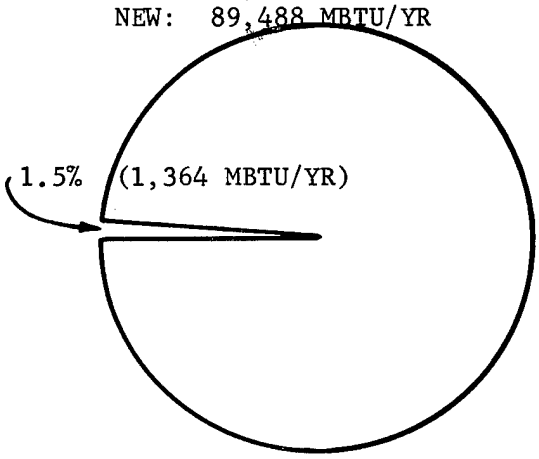
FIGURE 3. IMPACT OF ENERGY SAVINGS OF RECOMMENDED PROJECTS ON THE CURRENT ENERGY CONSUMPTION AT FT. SHAFTER, SCHOFIELD BARRACKS, AND TRIPLER AMC.

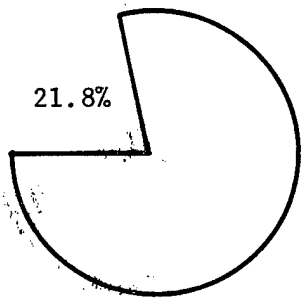
BASEWIDE	BUILDINGS IN THIS STUDY
SCHOFIELD BARRACKS:	
NOW: 397,451 MBTU/YR	NOW: 39,868 MBTU/YR
NEW: 390,842 MBTU/YR	NEW: 33,259 MBTU/YR





FT. SHAFTER:	
NOW: 90,852 MBTU/YR	NOW: 6,248 MBTU/YR
NEW: 89,488 MBTU/YR	NEW: 4,884 MBTU/YR





TRIPLER AMC:	
NOW: 141,861 MBTU/YR	NOW: 1,246 MBTU/YR
NEW: 141,826 MBTU/YR	NEW: 1,211 MBTU/YR